



Illinois Department of Transportation

To: Kensil Garnett Attn: Craig Emberton
From: Maureen M. Addis *MA*
Subject: Pavement Design Approval
Date: September 8, 2017

Route: Mattis Avenue Contract #2 of I-57/74 Interchange
Section: (10-34HB-3)BR & (10-5-1HB)BR-1 Contract No.: 70B38
County: Champaign Target Letting: FY 2018
Limits: Over I-57 and I-74 at Champaign

On September 8, 2017, the Pavement Selection Committee met to review the pavement design for the above referenced project which was submitted on June 30, 2017.

The scope of the project involves replacing the structures carrying Mattis Avenue over I-57 and I-74 in order to accommodate reconstruction of the I-57/74 interchange. The length of Mattis Ave. over I-57 to be reconstructed is 271 feet and the cross-section will be two 12' lanes with 8' shoulders. The length of Mattis Ave. over I-74 to be reconstructed is 273 feet and the cross-section will be four 12' lanes with a 12' flush median and 4' paved shoulders.

The pavement design resulted in two pavement options for small segment:

- Mattis Ave. over I-57: 9.25" Full-Depth HMA and 8.25" PCC. The life-cycle cost analysis of those options resulted in the HMA pavement being 8% less expensive (\$88,935 compared to PCC's cost of \$96,079). Due to the short length of the improvement combined with the existing HMA pavement along the rest of Mattis Ave., the District preferred the HMA option in-lieu of alternate bidding.
- Mattis Ave. over I-74: 9.25" Full-Depth HMA and 8.25" PCC. The life-cycle cost analysis of those options resulted in the HMA pavement being 12.4% less expensive (\$157,008 compared to PCC's cost of \$176,549). Due to the HMA's lower cost, the short length of the improvement and the existing HMA pavement along the rest of the roadway, the District preferred the HMA option.

The Pavement Selection Committee concurred with the District's preferences. In summary, the approved pavement designs are as follows:

Mattis Ave. over I-57

9.25" Full-Depth HMA Pavement with HMA Shoulders
12" Improved Subgrade

Mattis Ave. over I-74:

9.25" Full-Depth HMA Pavement with HMA Shoulders
12" Improved Subgrade

If you have any questions, please contact Mike Brand at (217) 782-7651.

Pavement Design

F.A.I. 57 (I-57) and F.A.I. 74 (I-74) Interchange Reconstruction

Contract 2: 70B38

Section (10-34HB-3)BR & (10-5-1HB)BR-1
Mattis Ave over I-57 & Mattis Ave over I-74

Champaign, IL
Champaign County



June 2017

Prepared For:



**Illinois Department
of Transportation**

Region 3 – District 5

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I. Introduction

This project is located at the Interstate 57 (I-57) & Interstate 74 (I-74) interchange on the northwest side of the City of Champaign, located in the central portion of Champaign County (see **Exhibit 1: Location Map**). The proposed scope of work includes the reconstruction of the I-74 & I-57 interchange and replacement of the existing full cloverleaf interchange with a semi-directional interchange with two directional flyovers, two loops, and four outer ramps.

The proposed improvements include pavement reconstruction and lane additions in each direction on I-74 from Duncan Road to North Prospect Avenue, pavement reconstruction of I-57 from the Norfolk Southern Railroad to Olympian Drive with accommodations for future lane additions to the inside, I-57 & I-74 ramp reconfiguration and pavement construction of eight new ramps, pavement reconstruction at three grade separation roadway approaches along Mattis Avenue and U.S. 150 (Bloomington Road), pavement reconstruction of two ramp terminals at I-57 & Olympian Drive, pavement reconstruction of two ramp terminals at I-74 & Prospect Avenue, and pavement reconstruction along Midwest Court (see **Exhibit 2: Project Overview**).

This project is currently planned to be completed under four separate construction contracts. The current contracts anticipated are:

- Contract 1 - 70B98: U.S. 150 (Bloomington Road) over I-57 roadway pavement and grade separation structure – Section (10-34HB)BR-1
- Contract 2 - 70B38: Mattis Avenue over I-57 & I-74 roadway pavements and grade separation structures – Section (10-34HB-3)BR&(10-5-1HB)BR-1
- Contract 3 - 70B99: I-57 & I-74 interchange ramp roadway pavements and structures (except Ramps A & H) – Section (10-34-1)HBK
- Contract 4 - 70C01: I-57 & I-74 roadway pavements and structures and all remaining ramp roadway pavements – Section (10-34HB-3)BR&(10-5-1HB)BR-1

II. Pavement Design and Life-Cycle Cost Analysis

The IDOT Mechanistic Pavement Design and Life-Cycle Cost Analysis (LCCA) spreadsheet (Rev. 09/05/2013) was utilized to determine the proposed pavement materials, thicknesses, and costs included herein. Standard equivalency factors for SU and MU vehicles were used to assume the mix of fully loaded, partially loaded, and empty vehicles for calculation of the traffic factors. The structural design traffic is shown for each roadway in **Exhibit 5: Traffic Data**. Full-depth pavement designs were performed for Contract 2 for the following roadways:

- Mattis over I-57
- Mattis over I-74

Pavement and shoulder removal costs were not included in the LCCA since they are required for all feasible designs. The rigid pavement designs include a 4" stabilized subbase in accordance with BDE Section 54-4.01(h)-2 and BDE Figure 54-4.D. A 4" stabilized subbase is not required by policy for the Mattis over I-74 roadway approaches but has been included for analysis purposes. 12" aggregate subgrade improvements are proposed for both roadways. These subgrade improvements satisfy the requirements in BDE Section 54-4.01(h)-1 and the recommendations in the Roadway Geotechnical Report. See **Exhibit 4: Roadway Geotechnical Report**.

A. Mattis Avenue over I-57

The grade separation and roadway approaches for Mattis Avenue over I-57 are proposed to be single 12' lanes in each direction with 8' paved shoulders along both edges of pavement. See **Exhibit 3: Proposed Typical Sections**. The total roadway approach length for Mattis Avenue over I-57 full depth pavement reconstruction is 271 feet.

Full depth shoulders are recommended for Mattis over I-57 to accommodate staged construction for this project and future maintenance and reconstruction activities.

The Mechanistic Pavement Design and Life-Cycle Cost Analysis for Mattis Avenue over I-57 with full depth shoulders is summarized below. See **Exhibit 6: Mechanistic Pavement Design and Life-Cycle Cost Analysis** for detailed calculations.

Mattis over I-57 Pavement Design & LCCA

	Traffic Factor	Depth (in)	Initial Cost	Life-Cycle Cost
HMA	1.61	9.25	\$61,475	\$88,935
JPCP	2.25	8.25	\$76,591	\$96,079

The results of the Life-Cycle Cost Analysis indicate that HMA is the lowest cost option compared to JPCP by 8.0%.

Although the LCCA did not result in one design being more than 10% cheaper than the other, the alternate pavement bidding process should not be considered for this roadway. The improvement along Mattis over I-57 is less than two lane-miles, so it does not meet BDE Section 54-1.04(a) criteria to be considered for alternate bidding. Also, the adjoining pavement surface on either end of the proposed improvement is HMA, so a rigid pavement structure for this short section of roadway is not recommended.

The recommended pavement design for Mattis Avenue over I-57 is a flexible pavement with a thickness of 9.25 inches and full depth HMA shoulders:

Lane Pavement

- HMA Pavement (Full-Depth), 9.25"
 - Polymerized HMA Surface Course, Mix "D", N70, 2" (IL-9.5, SBS PG 64-28)
 - Polymerized HMA Binder Course, IL-19.0, N70, 2.25" (SBS PG 64-28)
 - HMA Binder Course, IL-19.0, N70, 5" (PG 64-22)
- Subbase Granular Material Type A, 12"

Shoulder Pavement

- HMA Shoulders, 9.25"
 - HMA Surface Course, Mix "C", N50, 2" (PG 64-22)
 - HMA Binder Course, IL-19.0, N50, 7.25" (PG 64-22)
- Subbase Granular Material Type A, 12"

B. Mattis Avenue over I-74

The grade separation and roadway approaches for Mattis Avenue over I-74 are proposed to be two 12' lanes in each direction with a 12' paved flush median and 4' paved shoulders along both edges of pavement with B-6.24 combination concrete curb and gutter. See **Exhibit 3: Proposed Typical Sections**. The total roadway approach length for Mattis Avenue over I-74 full depth pavement reconstruction is 273 feet.

Full depth shoulders are recommended for Mattis over I-74 to accommodate staged construction for this project and future maintenance and reconstruction activities.

The Mechanistic Pavement Design and Life-Cycle Cost Analysis for Mattis Avenue over I-74 with full depth shoulders is summarized below. See **Exhibit 6: Mechanistic Pavement Design and Life-Cycle Cost Analysis** for detailed calculations.

Mattis over I-74 Pavement Design & LCCA

	Traffic Factor	Depth (in)	Initial Cost	Life-Cycle Cost
HMA	1.50	9.25	\$119,022	\$157,008
JPCP	1.84	8.25	\$145,112	\$176,549

The results of the Life-Cycle Cost Analysis indicate that HMA is the lowest cost option compared to JPCP by 12.4%.

A rigid pavement structure is not recommended for this roadway, because the adjoining pavement on either end of the proposed improvement is HMA and the life-cycle cost analysis resulted in the HMA being more than 10% cheaper than JPCP.

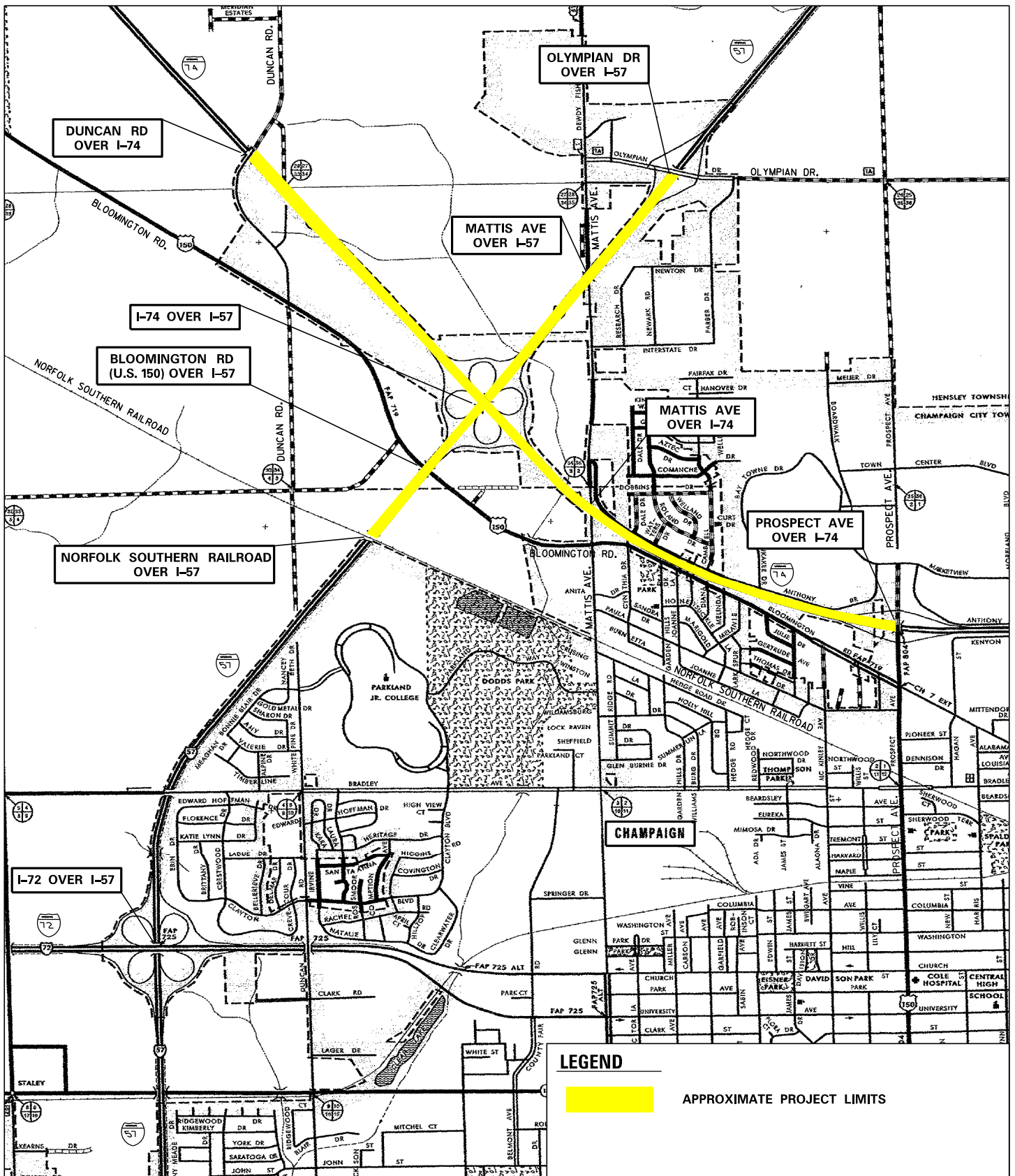
The recommended pavement design for Mattis Avenue over I-57 is a flexible pavement with a thickness of 9.25 inches and full depth HMA shoulders:

Lane Pavement

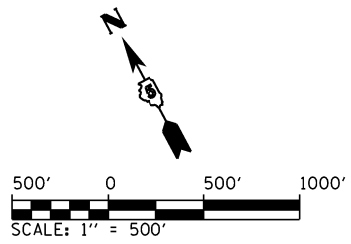
- HMA Pavement (Full-Depth), 9.25"
 - Polymerized HMA Surface Course, Mix "D", N70, 2" (IL-9.5, SBS PG 64-28)
 - Polymerized HMA Binder Course, IL-19.0, N70, 2.25" (SBS PG 64-28)
 - HMA Binder Course, IL-19.0, N70, 5" (PG 64-22)
- Subbase Granular Material Type A, 12"

Shoulder Pavement

- HMA Shoulders, 9.25"
 - HMA Surface Course, Mix "C", N50, 2" (PG 64-22)
 - HMA Binder Course, IL-19.0, N50, 7.25" (PG 64-22)
- Subbase Granular Material Type A, 12"



SCALE: 1" = 2,400'



FILE NAME = L:\IDOT\1106602\Draw\Exhibits\...	USER NAME = Brad Downen	DESIGNED -	REVISED -	STATE OF ILLINOIS DEPARTMENT OF TRANSPORTATION	I-57 & I-74 INTERCHANGE RECONSTRUCTION PROJECT OVERVIEW		F.A. RTÉ.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
	PLOT SCALE = 1000.0000' / in.	DRAWN -	REVISED -						CHAMPAIGN		
	PLOT DATE = 4/14/2016 11:42:43 AM	CHECKED -	REVISED -		SHEET 1 OF 1 SHEETS STA. TO STA.		CONTRACT NO. 70897				
		DATE -	REVISED -				ILLINOIS FED. AID PROJECT				

PROJECT AND TRAFFIC INPUTS

(Enter Data in Gray Shaded Cells)

Route: **Mattis Ave over I-57**
 Section: **(10-34HB-3)BR&(10-5-1HB)BR-1**
 County: **Champaign**
 Location: **Champaign, IL**

Comments:

Design Date: **06/30/2017** **CMT**

Modify Date:

<-- BY

<-- BY

	ADT	Year
Current:	7,090	2020
Future:	9,290	2040

Facility Type **Unmarked State Route**# of Lanes = **2 or 3**Part of future 4 lanes or more ? **No**One Way Street ? **No**Road Class: **II**Subgrade Support Rating (SSR): **Poor**Construction Year: **2020**Design Period (DP) = **20** years

	Minimum ADT	Structural Design Traffic		% of ADT in Design Lane
		Actual ADT	Actual % of Total ADT	
PV =	No Min	7,527	91.9%	P = 50%
SU =	No Min	352	4.3%	S = 50%
MU =	No Min	311	3.8%	M = 50%
Struct. Design ADT =		8,190	(2030)	

TRAFFIC FACTOR CALCULATION

FLEXIBLE PAVEMENT

Cpv = 0.15

Csu = **112.06**Cmu = **385.44**

TF flexible (Actual) = 1.61 (Actual ADT)

TF flexible (Min) = No Min (Min ADT Fig. 54-2.C)

RIGID PAVEMENT

Cpv = 0.15

Csu = **135.78**Cmu = **567.21**

TF rigid (Actual) = 2.25 (Actual ADT)

TF rigid (Min) = No Min (Min ADT Fig. 54-2.C)

NEW CONSTRUCTION / RECONSTRUCTION PAVEMENT DESIGN CALCULATIONS

Full-Depth HMA Pavement

Use TF flexible = 1.61

PG Grade Lower Binder Lifts = **PG 64-22** (Fig. 53-4.R)HMA Mixture Temp. = **77.5** deg. F (Fig. 54-5.C)Design HMA Mixture Modulus (E_{HMA}) = 620 ksi (Fig. 54-5.D)Design HMA Strain (ϵ_{HMA}) = 105 (Fig. 54-5.E)

Full Depth HMA Design Thickness = 9.25 in. (Fig. 54-5.F)

Limiting Strain Criterion Thickness = **15.75** in. (Fig. 54-5.I)Use Full-Depth HMA Thickness = **9.25** inches

JPC Pavement

Use TF rigid = 2.25

Edge Support = **Tied** Shoulder or C.&G.Rigid Pavt Thick. = **8.25** in. (Fig. 54-4.E)

CRC Pavement

Use TF rigid = 2.25

IBR value = **3**CRCP Thickness = **7.00** in. (Fig. 54-4.N)

TF MUST BE > 60 FOR CRCP

RECONSTRUCTION ONLY (SUPPLEMENTAL) PAVEMENT DESIGN CALCULATIONS

HMA Overlay of Rubblized PCC

Use TF flexible = 1.61

HMA Overlay Design Thickness = 6.50 in. (Fig. 54-5.U)

Limiting Strain Criterion Thickness = in. (Fig. 54-5.V)

Use HMA Overlay Thickness = **999.00** inches

Unbonded Concrete Overlay

Review 54-4.03 for limitations and special considerations.

JPCP Thickness = **NA** inches

CONTACT BMPR FOR ASSISTANCE

DESIGN TABLES FROM BDE MANUAL CHAPTER 54 - PAVEMENT DESIGN

Class I Roads	Class II Roads	Class III Roads	Class IV Roads
4 lanes or more Part of a future 4 lanes or more One-way Streets with ADT > 3500	2 lanes with ADT > 2000 One way Street with ADT <= 3500	2 Lanes (ADT 750 - 2000)	2 Lanes (ADT < 750)

Facility Type	Min. Str. Design Traffic (Fig 54-2.C)		
	PV	SU	MU
Interstate or Freeway	0	500	1500
Other Marked State Route	0	250	750
Unmarked State Route	No Min	No Min	No Min

Class Table for One-Way Streets	
ADT	Class
0 - 3500	II
>3501	I

Class	Traffic Factor ESAL Coefficients			
	Rigid (Fig. 54-4.C)		Flexible (Fig. 54-5.B)	
	Csu	Cmu	Csu	Cmu
I	143.81	696.42	132.50	482.53
II	135.78	567.21	112.06	385.44
III	129.58	562.47	109.14	384.35
IV	129.58	562.47	109.14	384.35

Class Table for 2 or 3 lanes (not future 4 lane & not one-way street)	
ADT	Class
0 - 749	IV
750 - 2000	III
>2000	II

Number of Lanes	Design Lane Distribution Factors For Structural Design Traffic (Fig. 54-2.B)					
	Rural			Urban		
	P	S	M	P	S	M
1 Lane Ramp	100%	100%	100%	100%	100%	100%
2 or 3	50%	50%	50%	50%	50%	50%
4	32%	45%	45%	32%	45%	45%
6 or more	20%	40%	40%	8%	37%	37%

Standard Design

MAINTENANCE COSTS:		THICKNESS	MATERIAL	T	UNIT COST
ROUTINE MAINTENANCE ACTIVITY					\$0.00 / LANE-MILE / YEAR
HMA OVERLAY	PVMT SURF	(2.00")	1.0069	Surface M 2.00	\$10.94 / SQ YD
HMA OVERLAY	PVMT	(2.25")	1.0078	2.25	\$12.07 / SQ YD
HMA SURFACE MIX		(1.50")	1.0052	Surface M 1.50	\$8.19 / SQ YD
HMA BINDER MIX		(0.75")	1.0130	Leveling Binc 0.75	\$3.88 / SQ YD
HMA OVERLAY	SHLD (Year 30)	(2.25")		Shoulder 2.25	\$12.73 / SQ YD
HMA OVERLAY	SHLD	(2.00")		Shoulder 2.00	\$11.31 / SQ YD
MILLING	(2.00 IN)			2.00	\$3.00 / SQ YD
PARTIAL DEPTH	PVMT PATCH	(Mill & Fill Surf)		Surface M 2.00	\$80.86 / SQ YD
PARTIAL DEPTH	SHLD PATCH	(Mill & Fill Surf)		Shoulder 2.00	\$81.31 / SQ YD

PARTIAL DEPTH PVMT PATCH	(Mill & Fill +2.00 ")	Leveling Binc	2.00	\$80.22 / SQ YD
PARTIAL DEPTH SHLD PATCH	(Mill & Fill +2.00 ")	Shoulder	2.00	\$81.31 / SQ YD
LONGITUDINAL SHOULDER JOINT ROUT & SEAL				\$2.00 / LIN FT
CENTERLINE JOINT ROUT & SEAL				\$2.00 / LIN FT
RANDOM / THERMAL CRACK ROUT & SEAL		(100% Re		\$2.00 / LIN FT

FLEXIBLE TOTAL LIFE	\$88,935
FLEXIBLE TOTAL ANN	\$70,671

PCC PAVEMENT				JPCP					
ROUTE		Mattis Ave over I-57							
SECTION		(10-34HB-3)BR&(10-5-1HB)BR-1							
COUNTY		Champaign							
LOCATION		Champaign, IL							
FACILITY TYPE		NON-INTERSTATE							
PROJECT LENGTH		271 FT		== >		0.05 Miles			
# OF CENTERLINES		1 CL							
# OF LANES		2 LANES							
# OF EDGES		2 EP							
LANE WIDTH - AVERAGE		12 FT							
SHOULDER WIDTH		PCC	Left	8 FT					
		PCC	Right	8 FT					
		Total Width of Paved Shoulders		16 FT					
PAVEMENT THICKNESS (RIGID)		JPCP	8.25 IN		TIED SHLD				
SHOULDER THICKNESS				8.25 IN					
POLICY OVERLAY THICKNESS				2.50 IN					
RIGID PAVEMENT		TRAFFIC FACTORS		MINIMUM		ACTUAL		USE	
				No Min		2.25		2.25	
Worksheet Construction Type is		Reconstruction				The Pavement Type is		JPCP	
INITIAL COSTS									
ITEM		THICKNESS		100% QUA UNIT		UNIT PRICE		COST	
JPC PAVEMENT		(8.25")		723 SQ YD		\$46.81 / SQ YD		\$33,844	
PAVEMENT REINFORCEMENT				0 SQ YD		\$22.00 / SQ YD		\$0	
STABILIZED SUBBASE		(4.00")		723 SQ YD		\$19.00 / SQ YD		\$13,737	
PCC SHOULDERS		(8.25" to 8.25")		482 SQ YD		\$40.00 / SQ YD		\$19,280	
CURB & GUTTER				0 LIN FT		\$30.00 / LIN FT		\$0	
SUBBASE GRAN MATL TY C		(~ 2.85")		0 TONS *		\$25.00 / TON		\$0	
IMPROVED SUBGRADE:		Aggregate	Width = 41.0	1,235 SQ YD		\$0.00 / SQ YD		\$0	
Stabilized Subbase for Full Depth Shoulders				512 SQ YD *		\$19.00 / SQ YD		\$9,730	
Reserved For User Supplied Item				0 UNITS		\$0.00 / UNITS		\$0	
PAVEMENT REMOVAL				723 SQ YD		\$0.00 / SQ YD		\$0	
SHOULDER REMOVAL				482 SQ YD		\$0.00 / SQ YD		\$0	
Note: *		Denotes User Supplied Quantity				RIGID CONSTRUCTION		\$76,591	
						RIGID CONSTRUCTION		\$60,862	
MAINTENANCE COSTS:									
ITEM		THICKNESS		MATERIAL T		UNIT COST			
ROUTINE MAINTENANCE ACTIVITY						\$0.00 / LANE-MILE / YEAR			
HMA POLICY OVERLAY		(2.50")		2.50					
HMA POLICY OVERLAY PVMT		(2.50")		1.0087		2.50		\$13.37 / SQ YD	
HMA SURFACE MIX		(1.50")		1.0052		Surface M		1.50	\$8.19 / SQ YD
HMA BINDER MIX		(1.00")		1.0139		Leveling Binc		1.00	\$5.18 / SQ YD
HMA POLICY OVERLAY SHLD		(2.50")				Shoulder		2.50	\$14.14 / SQ YD
CLASS A PAVEMENT PATCHING						\$300.00 / SQ YD			
CLASS B PAVEMENT PATCHING						\$275.00 / SQ YD			
CLASS C SHOULDER PATCHING						\$145.00 / SQ YD			
PARTIAL DEPTH PVMT PATCH (Mill & Fill HMA Surf)				Surface M		1.50		\$78.15 / SQ YD	
PARTIAL DEPTH PVMT PATCH (Mill & Fill HMA 2.50")				Surface M		2.50		\$83.58 / SQ YD	
LONGITUDINAL SHOULDER JOINT ROUT & SEAL						\$2.00 / LIN FT			
CENTERLINE JOINT ROUT & SEAL						\$2.00 / LIN FT			
REFLECTIVE TRANSVERSE CRACK ROUT & SEAL						\$2.00 / LIN FT			
RANDOM CRACK ROUT & SEAL				(100% Rehab = 100.00' /		\$2.00 / LIN FT			
						RIGID TOTAL LIFE-C		\$96,079	
						RIGID TOTAL ANNUAL		\$76,348	

LIFE-CYCLE COST ANALYSIS: NEW DESIGN

Calculated / Re #####

CONSTRUCTION	INITIAL COST	JPCP		HMA	
		PRESENT '17	ANNUAL COST	PRESENT '17	ANNUAL COST
		\$76,591	\$60,862	\$61,475	\$48,850
MAINTENANCE	LIFE-CYCLE COST	PRESENT '17	\$19,488	PRESENT '17	\$27,460
		ANNUAL COST	\$15,486	ANNUAL COST	\$21,821
TOTAL	LIFE-CYCLE COST	PRESENT '17	\$96,079	PRESENT '17	\$88,935
		ANNUAL COST	\$76,348	ANNUAL COST	\$70,671

LIFE-CYCLE COST ANALYSIS: FINAL SUMMARY

LOWEST COST OPTION	=====HMA	\$70,671	
OTHER OPTIONS (LOWEST TO HIGHEST):	TYPE / PERCENT	\$76,348	8.0%

-

JOINTED PLAIN CONCRETE PAVEMENT
UNBONDED JOINTED PLAIN CONCRETE OVERLAY
Figure 54-7.A

MAINTENANCE ITEM		%	QUANTITY	UNIT	UNIT COST	COST	PRESENT WORTH
YEAR	10						
	PAVEMENT PATCH CLASS B	0.10%	1	SQ YD	\$275.00	\$275	
	PWF _n =	0.7441		PW =	0.7441 X	\$275	\$205
YEAR	15						
	PAVEMENT PATCH CLASS B	0.20%	1	SQ YD	\$275.00	\$275	
	PWF _n =	0.6419		PW =	0.6419 X	\$275	\$177
YEAR	20						
	PAVEMENT PATCH CLASS B	2.00%	14	SQ YD	\$275.00	\$3,850	
	SHOULDER PATCH CLASS C	0.50%	2	SQ YD	\$145.00	\$290	
	LONGITUDINAL SHLD JT R&S	100.00%	542	LIN FT	\$2.00	\$1,084	
	CENTERLINE JT R&S	100.00%	271	LIN FT	\$2.00	\$542	
	PWF _n =	0.5537		PW =	0.5537 X	\$5,766	\$3,192
YEAR	25						
	PAVEMENT PATCH CLASS B	3.00%	22	SQ YD	\$275.00	\$6,050	
	SHOULDER PATCH CLASS C	1.00%	5	SQ YD	\$145.00	\$725	
	PWF _n =	0.4776		PW =	0.4776 X	\$6,775	\$3,236
YEAR	30						
	NON-INTERSTATE						
	PAVEMENT PATCH CLASS B	4.00%	29	SQ YD	\$275.00	\$7,975	
	SHOULDER PATCH CLASS C	1.50%	7	SQ YD	\$145.00	\$1,015	
	HMA POLICY OVERLAY 2.5" (PVMT)	100.00%	723	SQ YD	\$13.37	\$9,664	
	HMA POLICY OVERLAY 2.5" (SHLD)	100.00%	482	SQ YD	\$14.14	\$6,814	
	PWF _n =	0.4120		PW =	0.4120 X	\$25,468	\$10,492
YEAR	35						
	NON-INTERSTATE						
	LONGITUDINAL SHLD JT R&S	100.00%	542	LIN FT	\$2.00	\$1,084	
	CENTERLINE JT R&S	100.00%	271	LIN FT	\$2.00	\$542	
	RANDOM CRACK R&S	50.00%	271	LIN FT	\$2.00	\$542	
	REFLECTIVE TRANSVERSE CRACK R&S	40.00%	173	LIN FT	\$2.00	\$346	
	PD PVMT PATCH M&F HMA 2.50"	0.10%	1	SQ YD	\$83.58	\$84	
	PWF _n =	0.3554		PW =	0.3554 X	\$2,598	\$923
YEAR	40						
	NON-INTERSTATE						
	PAVEMENT PATCH CLASS B	0.50%	4	SQ YD	\$275.00	\$1,100	
	LONGITUDINAL SHLD JT R&S	100.00%	542	LIN FT	\$2.00	\$1,084	
	CENTERLINE JT R&S	100.00%	271	LIN FT	\$2.00	\$542	
	REFLECTIVE TRANSVERSE CRACK R&S	60.00%	259	LIN FT	\$2.00	\$518	
	RANDOM CRACK R&S	50.00%	271	LIN FT	\$2.00	\$542	
	PD PVMT PATCH M&F HMA 2.50"	0.50%	4	SQ YD	\$83.58	\$334	
	PWF _n =	0.3066		PW =	0.3066 X	\$4,120	\$1,263
							\$19,488
	ROUTINE MAINTENANCE ACTIVITY		0.10	Lane Miles	\$0.00	\$0	\$0
						MAINTENANCE	\$19,488
	45 YEAR LIFE CYCLE	CRF _n = 0.0407852				MAINTENANCE	\$15,486

Printed:

06/30/2017

Lifecycle = 45 Years

Interest Rate = 3.00%

Standard Surface Thickness = 2.00 IN

HMA Surface (New Pavement) 2.00 IN

HMA Top Binder Course 2.25 IN

HMA Lower Binder Course 5.00 IN

HMA Policy Overlay for LSCD 2.00 IN

Interstate HMA Policy Overlay 3.75 IN

Surface 1.50 IN

Top Binder Mix 2.25 IN

Over HMA

Non-Interstate HMA Policy Overlay 2.25 IN

Surface 1.50 IN

WorkSheet Setting Leveling Binder Mix 0.75 IN

Standard Design

Thermal / Random Crack Route & Seal 110 FT / Sta / Lane

Random Crack Route & Seal 100 FT / Sta / Lane

Patching: Additional Labor Cost = \$67.00 / SQ YD

Standard Pavement Slope = -0.01563 FT/FT

Standard Shoulder Slope = -0.04167 FT/FT

Tied PCC Shoulder Outside Edge Thickness = 8.25 IN

Standard Stabilized Subbase Thickness = 4.00 IN

Standard Pavement Subbase Outhang = 0.00 FT

Standard Shoulder Subbase Outhang = 6.00 IN

Outside Edge ShldT = 8.25 IN

<=== (See Dark Orange Color in Diagrams Below)

<=== (See Dark Orange Color in Diagrams Below)

<=== (See Yellow Color in Diagrams Below)

Standard Foreslope = 4 :1 FT/FT

Standard Wedge = 1 :1 FT/FT

(PCC Pavement) Shoulder Wedge = 0.0001 :1 FT/FT

Standard Surface & Binder SW = 2.01600 TONS / CU YD ==> 112.0 LB per SQYD IN

Standard Shoulder Subbase SW = 2.05000 TONS / CU YD ==> 113.9 LB per SQYD IN

HMA_SD

NON-INTERSTATE

HMA Policy Overlay 2.25 IN

Surface 1.50 IN

Leveling Binder Mix 0.75 IN

2.50 IN

1.50 IN

1.00 IN

2.00 IN

2.00 IN

0.00 IN

HMA Policy Overlay

Surface

Leveling Binder Mix

Mirror
LSC Design

HMA_LSCD

NON-INTERSTATE

PROJECT AND TRAFFIC INPUTS

(Enter Data in Gray Shaded Cells)

Route: **Mattis Avenue over I-74**
 Section: **(10-34HB-3)BR&(10-5-1HB)BR-1**
 County: **Champaign**
 Location: **Champaign, IL**

Comments:

Design Date: **06/30/2017** **CMT**

Modify Date:

<-- BY

<-- BY

	ADT	Year
Current:	16,300	2020
Future:	18,700	2040

Facility Type **Unmarked State Route**# of Lanes = **4**Road Class: **I**Subgrade Support Rating (SSR): **Poor**Construction Year: **2020**Design Period (DP) = **20** years

Structural Design Traffic			
Minimum ADT	Actual ADT	Actual % of Total ADT	% of ADT in Design Lane
PV = No Min	16,625	95.0%	P = 32%
SU = No Min	735	4.2%	S = 45%
MU = No Min	140	0.8%	M = 45%
Struct. Design ADT = 17,500		(2030)	

TRAFFIC FACTOR CALCULATION

FLEXIBLE PAVEMENT

Cpv = 0.15

Csu = **132.5**Cmu = **482.53**

TF flexible (Actual) = 1.50 (Actual ADT)

TF flexible (Min) = No Min (Min ADT Fig. 54-2.C)

RIGID PAVEMENT

Cpv = 0.15

Csu = **143.81**Cmu = **696.42**

TF rigid (Actual) = 1.84 (Actual ADT)

TF rigid (Min) = No Min (Min ADT Fig. 54-2.C)

NEW CONSTRUCTION / RECONSTRUCTION PAVEMENT DESIGN CALCULATIONS

Full-Depth HMA Pavement

Use TF flexible = 1.50

PG Grade Lower Binder Lifts = **PG 64-22** (Fig. 53-4.R)HMA Mixture Temp. = **77.5** deg. F (Fig. 54-5.C)Design HMA Mixture Modulus (E_{HMA}) = 620 ksi (Fig. 54-5.D)Design HMA Strain (ϵ_{HMA}) = 107 (Fig. 54-5.E)

Full Depth HMA Design Thickness = 9.25 in. (Fig. 54-5.F)

Limiting Strain Criterion Thickness = **15.75** in. (Fig. 54-5.I)Use Full-Depth HMA Thickness = **9.25** inches

JPC Pavement

Use TF rigid = 1.84

Edge Support = **Tied** Shoulder or C.&G.Rigid Pavt Thick. = **8.25** in. (Fig. 54-4.E)

CRC Pavement

Use TF rigid = 1.84

IBR value = **3**CRCP Thickness = **7.00** in. (Fig. 54-4.M)

TF MUST BE > 60 FOR CRCP

RECONSTRUCTION ONLY (SUPPLEMENTAL) PAVEMENT DESIGN CALCULATIONS

HMA Overlay of Rubblized PCC

Use TF flexible = 1.50

HMA Overlay Design Thickness = 6.50 in. (Fig. 54-5.U)

Limiting Strain Criterion Thickness = **11.25** in. (Fig. 54-5.V)Use HMA Overlay Thickness = **6.50** inches

Unbonded Concrete Overlay

Review 54-4.03 for limitations and special considerations.

JPCP Thickness = **NA** inches

CONTACT BMPR FOR ASSISTANCE

DESIGN TABLES FROM BDE MANUAL CHAPTER 54 - PAVEMENT DESIGN

Class I Roads	Class II Roads	Class III Roads	Class IV Roads
4 lanes or more Part of a future 4 lanes or more One-way Streets with ADT > 3500	2 lanes with ADT > 2000 One way Street with ADT <= 3500	2 Lanes (ADT 750 - 2000)	2 Lanes (ADT < 750)

Facility Type	Min. Str. Design Traffic (Fig 54-2.C)		
	PV	SU	MU
Interstate or Freeway	0	500	1500
Other Marked State Route	0	250	750
Unmarked State Route	No Min	No Min	No Min

Class Table for One-Way Streets	
ADT	Class
0 - 3500	II
>3501	I

Class	Traffic Factor ESAL Coefficients			
	Rigid (Fig. 54-4.C)		Flexible (Fig. 54-5.B)	
	Csu	Cmu	Csu	Cmu
I	143.81	696.42	132.50	482.53
II	135.78	567.21	112.06	385.44
III	129.58	562.47	109.14	384.35
IV	129.58	562.47	109.14	384.35

Class Table for 2 or 3 lanes (not future 4 lane & not one-way street)	
ADT	Class
0 - 749	IV
750 - 2000	III
>2000	II

Number of Lanes	Design Lane Distribution Factors For Structural Design Traffic (Fig. 54-2.B)					
	Rural			Urban		
	P	S	M	P	S	M
1 Lane Ramp	100%	100%	100%	100%	100%	100%
2 or 3	50%	50%	50%	50%	50%	50%
4	32%	45%	45%	32%	45%	45%
6 or more	20%	40%	40%	8%	37%	37%

Standard Design

Read Me!

MAINTENANCE COSTS:		THICKNESS	MATERIAL	T	UNIT COST
ROUTINE MAINTENANCE ACTIVITY					\$0.00 / LANE-MILE / YEAR
HMA OVERLAY	PVMT SURF	(2.00")	1.0035	Surface M	2.00 \$10.90 / SQ YD
HMA OVERLAY	PVMT	(2.25")	1.0039		2.25 \$12.03 / SQ YD
HMA SURFACE MIX		(1.50")	1.0026	Surface M	1.50 \$8.17 / SQ YD
HMA BINDER MIX		(0.75")	1.0065	Leveling Binc	0.75 \$3.86 / SQ YD
HMA OVERLAY	SHLD (Year 30)	(2.25")		Shoulder	2.25 \$12.73 / SQ YD
HMA OVERLAY	SHLD	(2.00")		Shoulder	2.00 \$11.31 / SQ YD
MILLING	(2.00 IN)				2.00 \$3.00 / SQ YD
PARTIAL DEPTH	PVMT PATCH	(Mill & Fill Surf)		Surface M	2.00 \$80.86 / SQ YD
PARTIAL DEPTH	SHLD PATCH	(Mill & Fill Surf)		Shoulder	2.00 \$81.31 / SQ YD

PARTIAL DEPTH PVMT PATCH	(Mill & Fill +2.00 ")	Leveling Binc	2.00	\$80.22 / SQ YD
PARTIAL DEPTH SHLD PATCH	(Mill & Fill +2.00 ")	Shoulder	2.00	\$81.31 / SQ YD
LONGITUDINAL SHOULDER JOINT ROUT & SEAL				\$2.00 / LIN FT
CENTERLINE JOINT ROUT & SEAL				\$2.00 / LIN FT
RANDOM / THERMAL CRACK ROUT & SEAL		(100% Re		\$2.00 / LIN FT

FLEXIBLE TOTAL LIFE	\$157,008
FLEXIBLE TOTAL ANN	\$123,850

PCC PAVEMENT				JPCP	
ROUTE		Mattis Avenue over I-74			
SECTION		(10-34HB-3)BR&(10-5-1HB)BR-1			
COUNTY		Champaign			
LOCATION		Champaign, IL			
FACILITY TYPE		NON-INTERSTATE			
PROJECT LENGTH		273 FT		= = >	0.05 Miles
# OF CENTERLINES		1 CL			
# OF LANES		4 LANES			
# OF EDGES		2 EP			
LANE WIDTH - AVERAGE		12 FT			
SHOULDER WIDTH		PCC	Left	4 FT	
		PCC	Right	4 FT	
		Total Width of Paved Shoulders		8 FT	
PAVEMENT THICKNESS (RIGID)		JPCP	8.25 IN	TIED SHLD	
SHOULDER THICKNESS			8.25 IN		
POLICY OVERLAY THICKNESS			2.50 IN		
RIGID PAVEMENT TRAFFIC FACTORS		MINIMUM		ACTUAL	USE
		No Min		1.84	
Worksheet Construction Type is		Reconstruction		The Pavement Type is JPCP	
INITIAL COSTS					
ITEM	THICKNESS	100% QUA	UNIT	UNIT PRICE	COST
JPC PAVEMENT	(8.25")	1,456	SQ YD	\$46.81 / SQ YD	\$68,155
PAVEMENT REINFORCEMENT		0	SQ YD	\$22.00 / SQ YD	\$0
STABILIZED SUBBASE	(4.00")	1,456	SQ YD	\$19.00 / SQ YD	\$27,664
PCC SHOULDERS	(8.25" to 8.25")	243	SQ YD	\$40.00 / SQ YD	\$9,720
CURB & GUTTER		1,146	LIN FT *	\$30.00 / LIN FT	\$34,380
SUBBASE GRAN MATL TY C	(~ 3.78")	0	TONS *	\$25.00 / TON	\$0
IMPROVED SUBGRADE:	Aggregate Width = 57.0	1,729	SQ YD	\$0.00 / SQ YD	\$0
Stabilized Subbase for Full Depth Shoulders		273	SQ YD *	\$19.00 / SQ YD	\$5,193
Reserved For User Supplied Item		0	UNITS	\$0.00 / UNITS	\$0
PAVEMENT REMOVAL		1,456	SQ YD	\$0.00 / SQ YD	\$0
SHOULDER REMOVAL		243	SQ YD	\$0.00 / SQ YD	\$0
Note: * Denotes User Supplied Quantity				RIGID CONSTRUCTION	\$145,112
				RIGID CONSTRUCTION	\$114,466
MAINTENANCE COSTS:					
ITEM	THICKNESS	MATERIAL	T	UNIT COST	
ROUTINE MAINTENANCE ACTIVITY				\$0.00 / LANE-MILE / YEAR	
HMA POLICY OVERLAY	(2.50")		2.50		
HMA POLICY OVERLAY PVMT	(2.50")	1.0043	2.50	\$13.32 / SQ YD	
HMA SURFACE MIX	(1.50")	1.0026	Surface IV	1.50 \$8.17 / SQ YD	
HMA BINDER MIX	(1.00")	1.0069	Leveling Binc	1.00 \$5.15 / SQ YD	
HMA POLICY OVERLAY SHLD	(2.50")		Shoulder	2.50 \$14.14 / SQ YD	
CLASS A PAVEMENT PATCHING				\$300.00 / SQ YD	
CLASS B PAVEMENT PATCHING				\$275.00 / SQ YD	
CLASS C SHOULDER PATCHING				\$145.00 / SQ YD	
PARTIAL DEPTH PVMT PATCH (Mill & Fill HMA Surf)		Surface IV	1.50	\$78.15 / SQ YD	
PARTIAL DEPTH PVMT PATCH (Mill & Fill HMA 2.50")		Surface IV	2.50	\$83.58 / SQ YD	
LONGITUDINAL SHOULDER JOINT ROUT & SEAL				\$2.00 / LIN FT	
CENTERLINE JOINT ROUT & SEAL				\$2.00 / LIN FT	
REFLECTIVE TRANSVERSE CRACK ROUT & SEAL				\$2.00 / LIN FT	
RANDOM CRACK ROUT & SEAL		(100% Rehab = 100.00' /		\$2.00 / LIN FT	
				RIGID TOTAL LIFE-C	\$176,549
				RIGID TOTAL ANNUAL	\$139,264

LIFE-CYCLE COST ANALYSIS: NEW DESIGN

Calculated / Re #####

CONSTRUCTION	INITIAL COST	JPCP		HMA
		PRESENT '17		
		\$145,112		\$119,022
MAINTENANCE	LIFE-CYCLE COST	ANNUAL COST		
		\$114,466		\$93,886
TOTAL	LIFE-CYCLE COST	PRESENT '17		
		\$31,437		\$37,986
		\$24,798		\$29,964
TOTAL	LIFE-CYCLE COST	PRESENT '17		
		\$176,549		\$157,008
		\$139,264		\$123,850

LIFE-CYCLE COST ANALYSIS: FINAL SUMMARY

LOWEST COST OPTION	=====HMA	\$123,850	
OTHER OPTIONS (LOWEST TO HIGHEST):	TYPE / PEJPCP	\$139,264	12.4%

-

JOINTED PLAIN CONCRETE PAVEMENT
UNBONDED JOINTED PLAIN CONCRETE OVERLAY
Figure 54-7.A

MAINTENANCE ITEM		%	QUANTITY	UNIT	UNIT COST	COST	PRESENT WORTH
YEAR	10						
	PAVEMENT PATCH CLASS B	0.10%	1	SQ YD	\$275.00	\$275	
	PWF _n =	0.7441		PW =	0.7441 X	\$275	\$205
YEAR	15						
	PAVEMENT PATCH CLASS B	0.20%	3	SQ YD	\$275.00	\$825	
	PWF _n =	0.6419		PW =	0.6419 X	\$825	\$530
YEAR	20						
	PAVEMENT PATCH CLASS B	2.00%	29	SQ YD	\$275.00	\$7,975	
	SHOULDER PATCH CLASS C	0.50%	1	SQ YD	\$145.00	\$145	
	LONGITUDINAL SHLD JT R&S	100.00%	546	LIN FT	\$2.00	\$1,092	
	CENTERLINE JT R&S	100.00%	273	LIN FT	\$2.00	\$546	
	PWF _n =	0.5537		PW =	0.5537 X	\$9,758	\$5,403
YEAR	25						
	PAVEMENT PATCH CLASS B	3.00%	44	SQ YD	\$275.00	\$12,100	
	SHOULDER PATCH CLASS C	1.00%	2	SQ YD	\$145.00	\$290	
	PWF _n =	0.4776		PW =	0.4776 X	\$12,390	\$5,918
YEAR	30						
	NON-INTERSTATE						
	PAVEMENT PATCH CLASS B	4.00%	58	SQ YD	\$275.00	\$15,950	
	SHOULDER PATCH CLASS C	1.50%	4	SQ YD	\$145.00	\$580	
	HMA POLICY OVERLAY 2.5" (PVMT)	100.00%	1,456	SQ YD	\$13.32	\$19,387	
	HMA POLICY OVERLAY 2.5" (SHLD)	100.00%	243	SQ YD	\$14.14	\$3,432	
	PWF _n =	0.4120		PW =	0.4120 X	\$39,349	\$16,211
YEAR	35						
	NON-INTERSTATE						
	LONGITUDINAL SHLD JT R&S	100.00%	546	LIN FT	\$2.00	\$1,092	
	CENTERLINE JT R&S	100.00%	273	LIN FT	\$2.00	\$546	
	RANDOM CRACK R&S	50.00%	546	LIN FT	\$2.00	\$1,092	
	REFLECTIVE TRANSVERSE CRACK R&S	40.00%	346	LIN FT	\$2.00	\$692	
	PD PVMT PATCH M&F HMA 2.50"	0.10%	1	SQ YD	\$83.58	\$84	
	PWF _n =	0.3554		PW =	0.3554 X	\$3,506	\$1,246
YEAR	40						
	NON-INTERSTATE						
	PAVEMENT PATCH CLASS B	0.50%	7	SQ YD	\$275.00	\$1,925	
	LONGITUDINAL SHLD JT R&S	100.00%	546	LIN FT	\$2.00	\$1,092	
	CENTERLINE JT R&S	100.00%	273	LIN FT	\$2.00	\$546	
	REFLECTIVE TRANSVERSE CRACK R&S	60.00%	518	LIN FT	\$2.00	\$1,036	
	RANDOM CRACK R&S	50.00%	546	LIN FT	\$2.00	\$1,092	
	PD PVMT PATCH M&F HMA 2.50"	0.50%	7	SQ YD	\$83.58	\$585	
	PWF _n =	0.3066		PW =	0.3066 X	\$6,276	\$1,924
							\$31,437
	ROUTINE MAINTENANCE ACTIVITY		0.21	Lane Miles	\$0.00	\$0	\$0
						MAINTENANCE	\$31,437
	45 YEAR LIFE CYCLE	CRF _n = 0.0407852				MAINTENANCE	\$24,798

Printed:

06/30/2017

Lifecycle = 45 Years

Interest Rate = 3.00%

Standard Surface Thickness = 2.00 IN

HMA Surface (New Pavement) 2.00 IN

HMA Top Binder Course 2.25 IN

HMA Lower Binder Course 5.00 IN

HMA Policy Overlay for LSCD 2.00 IN

Interstate HMA Policy Overlay 3.75 IN

Surface 1.50 IN

Top Binder Mix 2.25 IN

Over HMA

Non-Interstate HMA Policy Overlay 2.25 IN

Surface 1.50 IN

WorkSheet Setting Leveling Binder Mix 0.75 IN

Standard Design

Thermal / Random Crack Route & Seal 110 FT / Sta / Lane

Random Crack Route & Seal 100 FT / Sta / Lane

Patching: Additional Labor Cost = \$67.00 / SQ YD

Standard Pavement Slope = -0.01563 FT/FT

Standard Shoulder Slope = -0.04167 FT/FT

Tied PCC Shoulder Outside Edge Thickness = 8.25 IN

Standard Stabilized Subbase Thickness = 4.00 IN

Standard Pavement Subbase Outhang = 0.00 FT

Standard Shoulder Subbase Outhang = 6.00 IN

Outside Edge ShldT = 8.25 IN

<=== (See Dark Orange Color in Diagrams Below)

<=== (See Dark Orange Color in Diagrams Below)

<=== (See Yellow Color in Diagrams Below)

Standard Foreslope = 4 :1 FT/FT

Standard Wedge = 1 :1 FT/FT

(PCC Pavement) Shoulder Wedge = 0.0001 :1 FT/FT

Standard Surface & Binder SW = 2.01600 TONS / CU YD ==> 112.0 LB per SQYD IN

Standard Shoulder Subbase SW = 2.05000 TONS / CU YD ==> 113.9 LB per SQYD IN

HMA_SD

NON-INTERSTATE

HMA Policy Overlay 2.25 IN

Surface 1.50 IN

Leveling Binder Mix 0.75 IN

2.50 IN

1.50 IN

1.00 IN

2.00 IN

2.00 IN

0.00 IN

HMA Policy Overlay

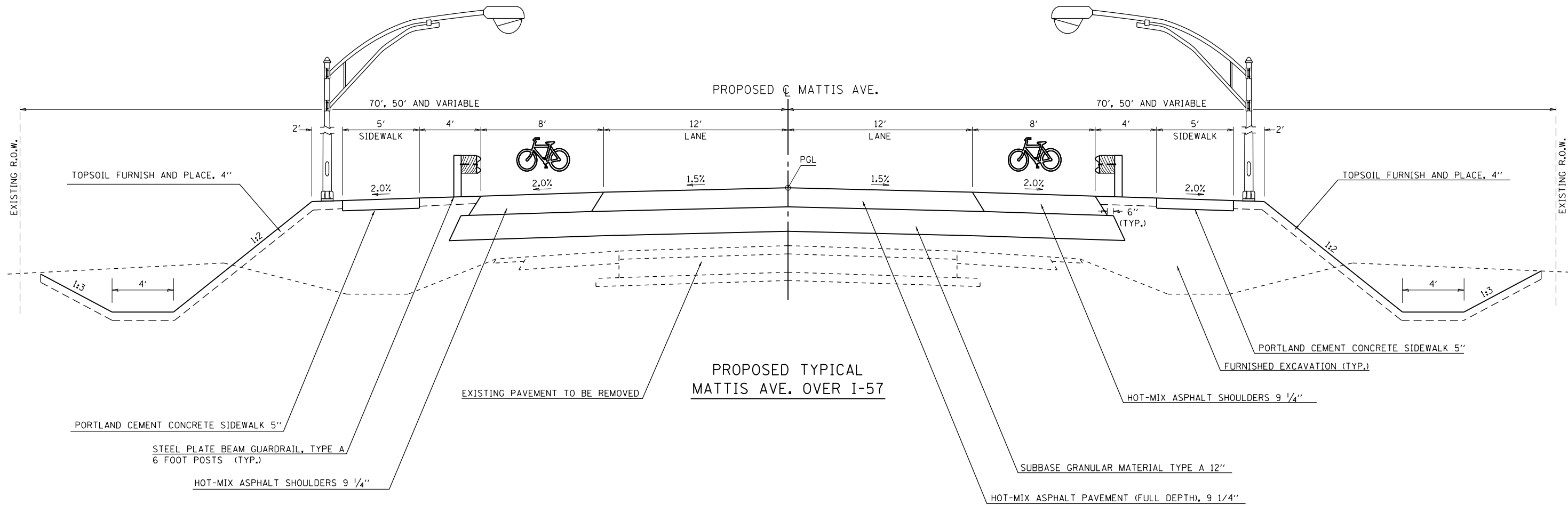
Surface

Leveling Binder Mix

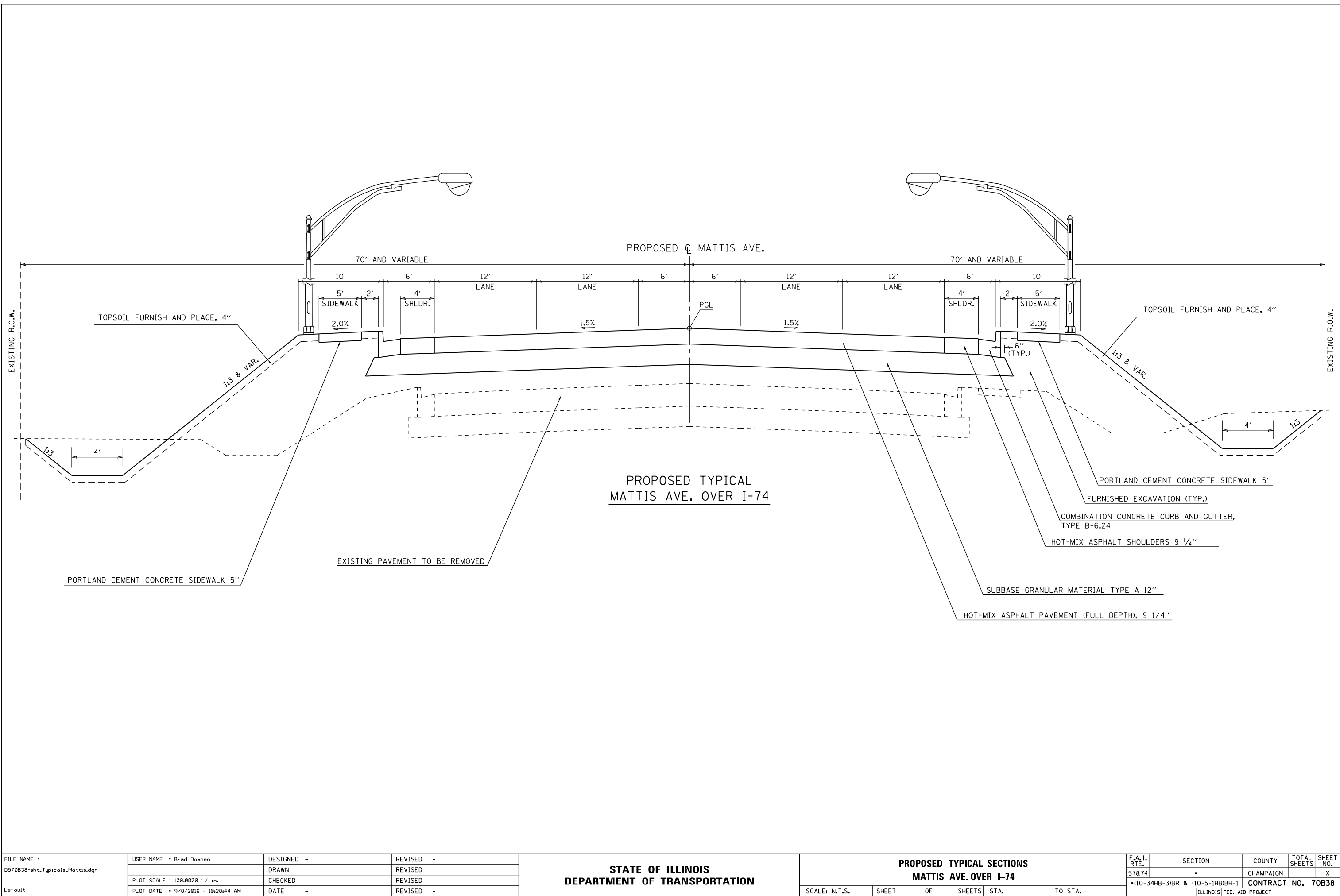
Mirror
LSC Design

HMA_LSCD

NON-INTERSTATE



FILE NAME = D570B38-sht.Typicals.Mattis.dgn Default	USER NAME = Brad Downen	DESIGNED -	REVISED -	STATE OF ILLINOIS DEPARTMENT OF TRANSPORTATION	PROPOSED TYPICAL SECTIONS MATTIS AVE. OVER I-57				F.A.I. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
		DRAWN -	REVISED -						57&74	•	CHAMPAIGN		X
	PLOT SCALE = 100.0000' / in.	CHECKED -	REVISED -						CONTRACT NO. 70B38				
	PLOT DATE = 9/8/2016 - 10:28:31 AM	DATE -	REVISED -		SCALE: N.T.S. SHEET OF SHEETS STA. TO STA.				ILLINOIS FED. AID PROJECT				



FILE NAME = D570B38-sht.Typicals_Mattis.dgn Default	USER NAME = Brad Downen	DESIGNED -	REVISED -	STATE OF ILLINOIS DEPARTMENT OF TRANSPORTATION	PROPOSED TYPICAL SECTIONS MATTIS AVE. OVER I-74				F.A.I. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
		DRAWN -	REVISED -						57&74	•	CHAMPAIGN		X
	PLOT SCALE = 100.0000' / in.	CHECKED -	REVISED -						CONTRACT NO. 70B38				
	PLOT DATE = 9/8/2016 - 10:28:44 AM	DATE -	REVISED -		SCALE: N.T.S.	SHEET	OF	SHEETS	STA.	TO	STA.	ILLINOIS FED. AID PROJECT	